CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: January 13, 2022 FILE REF: 3400

TO: File

FROM: Woody Myers - WCR

SUBJECT: Liberty S D 1 Wastewater Treatment Facility - Land Disposal System Evaluation Report, WPDES Permit # WI-0031828

Effluent & Groundwater Evaluation Summary

Table 1 Effluent Parameters and Limits

	Current Permit WI-0031828-07		Proposed Permit WI-0031828-08	
Parameter	Limits and Units	Limit Type	Limits and Units	Limit Type
Flow Rate	- MGD		- MGD	
BOD_5	50 mg/l	Monthly Avg	50 mg/l	Monthly Avg
Total Suspended Solids	- mg/l		- mg/l	
pH, Field	- su		- su	
Kjeldahl Nitrogen	- mg/l		- mg/l	
Ammonia	- mg/l		- mg/l	
Organic Nitrogen	- mg/l		- mg/l	
Total Nitrogen	- mg/l		- mg/l	
Nitrite + Nitrate as N	- mg/l		- mg/l	
Total Dissolved Solids	- mg/l		- mg/l	
Chloride	- mg/l		- mg/l	

No recommended permit changes

Table 2 Monitoring Wells

Well	Current Permit WI-0031828-07		Proposed Permit WI-0031828-08	
	Well Location	Well Designation	Well Location	Well Designation
801 MW-1	Down-gradient	Point of Standard	Down-gradient	Point of Standard
802 MW-2	Down-gradient	Point of Standard	Side-gradient	*Non-Point of Standard
803 MW-3	Up-gradient	Background	Up-gradient	*Non-Point of Standard
804 MW-4	Up-gradient	Non-Point of Standard	Side-gradient	Non-Point of Standard
805 MW-5	Side-gradient	Point of Standard	*Discontinue	
806 MW-6	Up-gradient	Point of Standard	Up-gradient	*Background
807 MW-7	Up-gradient	Point of Standard	*Discontinue	

* Recommended permit changes

Table 3 Groundwater Standards

Parameter	Current Permit WI-0031828-07		Proposed WI-0031828-08	
	PAL	ES	PAL	ES
Depth to Groundwater	N/A	N/A	N/A	N/A
Groundwater Elevation	N/A	N/A	N/A	N/A
pH	6.3-8.3 su	N/A	6.3-8.3 su	N/A
Nitrogen, Nitrite + Nitrate	2.0 mg/l	10.0 mg/l	2.0 mg/l	10.0 mg/l
Nitrogen Total Kjeldahl	N/A	N/A	N/A	N/A
Nitrogen, Ammonia	0.97 mg/l	9.7 mg/l	0.97 mg/l	9.7 mg/l
Nitrogen, Organic	6.3 mg/l	N/A	6.3 mg/l	N/A
Chloride	125 mg/l	250 mg/l	125 mg/l	250 mg/l
Total Dissolved Solids	778 mg/l	N/A	*780 mg/l	N/A
Manganese, Dissolved	0.06 mg/l	0.3 mg/l	0.06 mg/l	0.3 mg/l

* Recommended changes from previous permit

Site Information

The Liberty S D 1 Wastewater Treatment Facility is a municipal facility and is located at 14333 CTY F, Valders, Manitowoc County. Wastewater is currently treated via aerated settling lagoons and discharged to groundwater via absorption ponds (seepage cells) located in the NE ¼ of the NW ¼ and the NW ¼ of the NE ¼ of Section 4, T17N, R22E, Town of Meeme.

Geology

The bedrock under this facility is comprised of the undivided Cayugan, Niagaran and Alexandrian Series. These series are comprised of dolomitic sedimentary rock (*Bedrock Geologic Map of Wisconsin*, Wisconsin Geological and Natural History Survey (WGNHS), 1982). Bedrock is anticipated to be between 50 and 100 feet below ground surface (bgs) (*Depth to Bedrock in Wisconsin*, WGNHS, 1973). The regolith consists of material ranging from coarse sand to lean clay. Surface soil primarily consists of the Kewaunee loam and the Boyer sandy loam (USDA Web Soil Survey).

A review of the USGS Cleveland West Quadrangle (2018) topographic map was performed. The Liberty facility lies on the west toe of a ridge that runs north-northeast to south-southwest. This ridge is assumed to be comprised glacial till.

Hydrogeology

Calculated groundwater elevation ranges between 873 and 876 feet above mean sea level (msl). Depth to groundwater was reported to be between 23 and 40 feet bgs. Groundwater flow direction was calculated to be generally to the south. Regional groundwater is to the east-southeast in this area of Manitowoc County. The site is approximately 950 feet south of the Meeme River and 1,600 feet south of Little Pigeon Lake.

A review of known wells was performed as a part of this evaluation. These wells include municipal, other than municipal, private and high-capacity wells. There are 6 private wells within a 1,500-foot range of this facility's groundwater discharge.

Hydraulic and Nitrogen Loading Rates

There are two active outfalls at this facility. Outfall 001 is the discharge associated with the groundwater monitoring network.

Table 4 Sampling Points/Outfalls

Sampling Point (Outfall) Listed in SWAMP		
Number	Outfall Type	Description
Outfall 001	Land Disposal	Effluent, sand filters
Outfall 004	Municipal Sludge	Lagoon Sludge

The Table 5 is the average flow (hydraulic loading), total nitrogen and chloride loading summations for the Land Treatment System.

Table 5 Land Treatment Disposal Loading Averages

Year	Flow (MGD)	Nitrogen (mg/l)	Chloride (mg/l)
2021*	0.016	28.9	518
2020	0.020	24.8	470
2019	0.011	27.8	495
2018	0.011	25.1	524
2017	0.013	27.0	553
2016	0.012	27.2	613

* Indicates partial year

Groundwater Monitoring Network and Frequency (Previous Permit)

Groundwater samples were to be collected quarterly from wells 801(MW-1), 802(MW-2), 803(MW-3) and 805(MW-5). Samples were to be collected from well 806(MW-6) once it was installed. Well 803(MW-3) was designated as a background well and was used to calculate Preventative Action Limits (PAL) and Alternate Concentration Limits (ACL). Wells 801(MW-1), 802(MW-2), 803(MW-3), 805(MW-5) and 806(MW-6) were designated and sampled as "Point of Standards Application" wells.

Table 6 Groundwater Monitoring Well Data

Sample Point	Well Name	Elevation (feet above msl)					Well Type
		Casing Top	Ground Surface	Screen Top	Screen Bottom	Screen Length	
801	MW-1	906.75	904.38	875.4	865.4	10.0	WT
802	MW-2	904.20	900.80	874.8	864.8	10.0	WT
803	MW-3	913.59	910.28	878.3	863.8	10.0	WT
804	MW-4	897.73	894.90	873.9	863.9	9.0	P
805	MW-5	900.43	897.00	877.0	867.0	10.0	WT
806	MW-6	898.00	895.6	866.1	851.1	15.0	WT
807	Private well	Unknown					O

All measurements in feet
WT-Water table Observation P-Piezometer O-Other

The groundwater samples are analyzed for the following parameters: Nitrite + Nitrate, Chloride, Total Kjeldahl Nitrogen, Ammonia, Organic Nitrogen, pH, Manganese and Total Dissolved Solids (TDS). All of these parameters are analyzed for the aqueous or dissolved phase in groundwater. Established groundwater quality standards are found in s. NR140.10 Table 1 Public Health Groundwater Quality Standards, and NR140.12 Table 2 Public Welfare Groundwater Standards. The thresholds of these standards are the Enforcement Standard (ES) and the PAL.

Groundwater Conditions and Exceedances

Groundwater sampling results from this facility have been analyzed for each well to evaluate trends of regulated compounds in groundwater and to calculate PALs and ACLs where appropriate. The groundwater was evaluated by looking at approximately five years of monitoring results. PALs and ACLs are calculated from this time range.

The only significant exceedances of groundwater standards during the evaluation period were for nitrite + nitrate and manganese.

The monitored groundwater exceedances trend summary is as follows:

MW-1 (801)

Nitrogen, Nitrite + Nitrate
0 of 22 samples exceeded the ES
2 of 22 samples exceeded the PAL
maximum: 2.4 mg/l minimum: 0.4 mg/l average: 0.9 mg/l

MW-2 (802)

Nitrogen, Nitrite + Nitrate
0 of 22 samples exceeded the ES
9 of 22 samples exceeded the PAL
maximum: 5.1 mg/l minimum: 0.4 mg/l average: 2.0 mg/l

MW-3 (803)

Nitrogen, Nitrite + Nitrate
22 of 22 samples exceeded the ES
0 of 22 samples exceeded the PAL
maximum: 45 mg/l minimum: 23 mg/l average: 35.4 mg/l

MW-5 (805)

Dissolved Manganese
3 of 16 samples exceeded the ES
3 of 16 samples exceeded the PAL
maximum: 610 µg/l minimum: 1.4 µg/l average: 148 µg/l

Concentrations and trends in the groundwater monitoring data were compared to the loading data for the land treatment system. There were no correlations observed.

Proposed Groundwater Monitoring Requirements

The groundwater monitoring wells 801, 802, 803, 804 and 806 should be sampled quarterly for the parameters in the table below. No groundwater limits were calculated as a part of this groundwater evaluation. Changes are being suggested as to the designation of a well to be sampled as s. NR140.22 Wis. Adm. Code Point of Standard Application well (see Table 7).

Table 7 Well Sampling Recommendations

Well Name	Sample Point	Sample Frequency	Sample Parameters	Well Designation
801	MW-1	Quarterly	Table 8	Point of Standard
802	MW-2	Quarterly	Table 8	*Non-Point of Standard
803	MW-3	Quarterly	Table 8	*Non-Point of Standard
804	MW-4	*Quarterly	Table 8	Non-Point of Standard
805	MW-5	*Discontinue		
806	MW-6	Quarterly	Table 8	*Background
807	MW-7	*Discontinue		Private Well

* Recommended changes from previous permit

Table 8 Proposed Groundwater Standards –Permit WI-0031828-08

Parameter	PAL	ES	Source
Depth to Groundwater	N/A	N/A	Measured
Groundwater Elevation	N/A	N/A	Measured
pH	6.3-8.3 su	N/A	Calculated
Nitrogen, Nitrite + Nitrate	2.0 mg/l	10.0 mg/l	Table 1, NR140
Nitrogen, Total Kjeldahl	N/A	N/A	Measured
Nitrogen, Ammonia	0.97 mg/l	9.7 mg/l	Table 1, NR 140
Nitrogen, Organic	6.3 mg/l	N/A	Calculated
Chloride	125 mg/l	250 mg/l	Table 2, NR 140
Total Dissolved Solids	*780 mg/l	N/A	Calculated
Manganese, Total	0.06 mg/l	0.3 mg/l	Table 1, NR 140

* Recommended changes from previous permit

Conclusions

The groundwater monitoring wells do not appear to be properly placed based on the groundwater flow direction. A schedule is being recommended for the installation of a down-gradient well.

The groundwater samples from well 803 (MW-3) have been consistently above the s. NR140.10 Table 1 Wis. Adm. Code Enforcement Standard of 10 mg/l for nitrite + nitrate. The source of this nitrogen is unknown. Well 803 is hydrologically up-gradient of the facility, but not significantly. The facility has evaluated some of the potential sources but there are no conclusions yet. There are agricultural fields to the northeast and to the west of the facility. In addition, the facility is close to the groundwater influence of Pigeon and Little Pigeon Lakes, however the lake water quality appears to eliminate this as a source. There is an old borrow pit directly adjacent to northeast from the facility, however the history of this does not indicate that it is a likely source.

The new well 806 (MW-6) is up-gradient of the absorption ponds and was installed May 2021. The initial purpose for the well was to act as a sentry well to be sampled in lieu of the private well listed as 807. The groundwater monitoring results of this well indicate a nitrite + nitrate concentration of 0.6 mg/l. This is significantly less than the 35.4 mg/l average for well 803. It is recommended that well 806 be used in the future as the up-gradient background well. The well could not be used to establish PALs or ACLs because it has not been sampled the eight rounds needed to calculate a statistically significant limit. The PALs and ACLs will be calculated before the next permit issuance.

The PAL for TDS was increased a small increment to be consistent with the department's rounding guidance.

Overall, the facility is found to be substantially compliant with the regulations regarding the operation of a land disposal system in accordance with chs. NR 140 and NR 206 Wis. Adm. Code.

Compliance Schedule Recommendations

Install at least one down-gradient groundwater monitoring well. The well should be placed due south of the absorption ponds. The well should not be closer than 10 feet to the southern edge of the ponds and if possible, approximately 250 feet south but no greater than 500 feet south. Plans and specifications should be submitted to the department's plan review section for approval prior to the installation of the well.

Well 805 (MW-5) should be abandoned. Schedule abandonment and summit the abandonment forms to the department.

A map is required of the land treatment system per s. NR141.065 Wis. Adm. Code.
"All monitoring well locations shall be reported to the department on a plan map drawn to a specific scale. The map shall indicate structure boundaries, property boundaries, any nearby surface waters and a north arrow. The plan shall show the wells in relation to each other, to property and structure boundaries and to a common reference point on a horizontal grid system. The origin of the grid system shall be located according to latitude and longitude or according to the state plane coordinate system. The exact vertical location of the top of the well casing shall be referenced to the nearest benchmark for the national geodetic survey datum to an accuracy of 0.01 feet. This plan map shall show the exact location of the installed well on a horizontal grid system which is accurate to within 1 foot."

The facility should continue to evaluate the significant exceedances of nitrite + nitrate observed in well 803 (MW-3). Progress reports should be submitted to the department annually.

The facility should submit documentation to confirm the date that they ceased using well 807 to meet permit requirements.